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The Certification of Seed in International Trade for Sanitary Condition

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The certification of the sanitary condition of consignments of seed intended for propagation may seem a simple matter, but in fact it proves complicated and difficult to perform satisfactorily.

Two fundamentally different requirements concerning the health condition of seed in international commerce are to be distinguished. First, the government of the importing country may require the exporting country to issue a certificate attesting that the consignment is free from certain injurious diseases and pests and that it conforms with the current plant quarantine regulations of the importing country. Second, the buyer may ask for a guarantee that the seed lot does not contain more than certain percentages of infection, because the health condition is a factor in assessing the commercial value of the seed lot.

In order to establish a standard and simplified certificate form for plant quarantine uses, the International Plant Protection Convention of 1951 provides for a model phytosanitary certificate which is to be used for plant propagating materials including seed. However, this certificate is not intended nor adapted for the certification of seed with regard to the extent of disease infection as a factor in assessing its commercial value. For that purpose a different kind of certificate is needed. This paper discusses the desirable characteristics of the latter certificate, which might preferably be issued by the seed testing stations and which would also include information on purity, germinating capacity and other properties of the seed samples.

When seed passes in commerce within certain countries, or for export to countries which require that disease infections do not exceed certain percentages, or when the selling and purchasing firms or countries are interested in the extent of infection in the consignment as a factor that influences its value, a certificate must provide detailed information on this matter. Seed-borne inoculum may influence field emergence in a manner which cannot be properly indicated by the germination capacity figure, and seed-borne inoculum may be the starting point of disease development in the field. As the degree of infection or infestation has, and should be considered as having, an important bearing on the sowing quality and consequently the financial value of the seed, accurate and adequate information on this condition is imperative.

Certificates for International Use

For trade within any one country seed testing stations may issue certificates including information on the extent of disease infection of the seed. It is not difficult to devise a certificate for this purpose such that all concerned will have no difficulty in interpreting the wording. For international commerce, however, a more explicit form is required to prevent any misunderstandings which might arise, because the occurrence and relative importance of diseases and

pests differ so much in various countries. Furthermore, the knowledge of seed–borne diseases and pests and the degree to which this knowledge is put into practice in routine seed investigations vary greatly.

For reporting upon the sanitary condition of seeds for purposes of international commerce the certificates of the International Seed Testing Association (ISTA) might be used as they are adapted to record the figures which determine the commercial value of the seed. It is necessary however to decide how the ISTA certificate should be adjusted to provide information of the greatest practical value. The certificate should provide information concerning the methods of examination, and the quantity of seed investigated, and state the organisms for which the seed was inspected, with the amount of each determined. For this work every official seed testing station should have a trained plant pathologist on its staff.

All who are acquainted with the present state of knowledge of seed–transmitted diseases and routine methods of detecting them will appreciate that a general statement, such as one indicating freedom from all diseases and pests, is worthless, for the seed may only have seemed to be so on a very superficial inspection. In fact, with our present knowledge about seed–transmission of disease organisms and the present development of methods for seed inspection, no investigation can be exhaustive. We cannot, however, afford to wait until both our knowledge and methods become more complete. We should commence within the limitations of our knowledge, but ensure that the shortcomings of the examination are expressed in the certificate.

Experience in the Netherlands

Based upon experience accumulated at the Netherlands Seed Testing Station at Wageningen, the use of the ISTA certificate for seed in international commerce may be illustrated with some examples.

1. Wheat. An export seed sample of this crop might be certified for its sanitary condition as follows:

> "Five hundred gr. dry seed: free from storage insects, bunt balls, ergot sclerotia, and *Anguina* galls;
>
> Five hundred seeds, washing method: slightly infected with *Tilletia caries* and *T. foetida* (about 300 spores per 100 seeds), free from *Tilletia brevifaciens;*
>
> Four hundred seeds, blotter test: slightly infected with *Fusarium* spp. (about 9 percent), free from *Helminthosporium* spp."

Some experience in determining loose smut mycelium in barley seed is available and it is hoped before long to gain some experience with loose smut in wheat seeds. As however *Ustilago tritici* is of no practical importance in the Netherlands it might be justifiable to rely either on this fact or on a preceding field inspection by the certifying agency, and to include in the certificate a statement: "The sample was not investigated for *Ustilago tritici* as this fungus is only seldom seen in the Netherlands."

2. Pea. Pea seed for export might be certified as follows:

> "Five hundred gr. dry seed: free from injurious insects;
>
> Three hundred seeds, blotter test: moderately infected with *Ascochyta* spp. (about 10 percent), slightly infected with *Mycosphaerella* (about 2 percent) and *Stemphylium* (about 3 percent), also a moderate percentage of weak decaying seeds (about 11 percent);
>
> Two hundred seeds, blotter test: light degree of manganese deficiency (about 10 percent light and 4 percent severe cases of marsh spot)."

The "weak decaying seeds" were formerly termed "bacterial peas," but since *Pseudomonas pisi* is known to occur in the Netherlands this term might be misunderstood. The decay observed in the blotter test is the result of invasion of weak seeds by saprophytic moulds and bacteria, but is not due to *P. pisi*.

3. Flax. Flax seed might be certified as follows:

> "Five hundred gr. dry seed: free from storage insects and mites, from sclerotia of *Sclerotinia* and *Botrytis*, and from impurities with pycnidia of *Mycosphaerella;*
>
> One hundred seeds in water: slight *Polyspora* infection (about 1 percent);
>
> Four hundred seeds, blotter test: slightly infected with *Botrytis* (about 5 percent), *Fusarium* (about 1 percent), *Alternaria* (about 3 percent), free from *Colletotrichum*, *Ascochyta* and *Mycosphaerella*."

The species of the parasites, *Fusarium oxysporum*, f. *lini*, *Alternaria linicola*, etc., need not be mentioned as it is obvious that references are to parasitic fungi and not to secondary invaders.

The reference to saprophytes in the pea seed sample is an exception, justified by the extreme importance of weak pea seeds in determining the actual value of the seed lot. This information is useful in relation to resistance against unfavorable post–sowing conditions.

The certificates might include a statement concerning the effect of fungicide treatment, which statement may be founded on general experience instead of on a test with the sample itself.

It is essential to give an appraisal for infections of different diseases, besides the percentage figures, as otherwise the buyer abroad might use the reported infection percentages as a pretext to refuse a seed lot even when these percentages are quite normal in the exporting country.

The wording of the above examples, while containing nothing superfluous, indicates the accuracy and shortcomings of the investigation. Yet they are so complicated that most stations will be inclined to leave some details to be implied. The Netherlands station does not normally mention insects, as storage insects are scarcely ever seen in export samples and *Bruchus* is only present in imported pea seed. Moreover, as bunt balls and *Anguina* galls are never found in wheat samples, and as ergots are considered inert matter in the International Rules for Seed Testing, mention of these is also omitted. *Tilletia brevifaciens* is also not expressly mentioned, as dwarf bunt has not yet been found in the Netherlands. In addition, if after inspection for *Polyspora* in a few hundred samples of linseed of a new harvest, this cause of browning and stembreak appears, as usual, to be very infrequent, the inspection is discontinued and the disease is not mentioned in the certificate. It must however be realized that all these simplifications are not justified in relation to international commerce and in future they will have to be avoided.

It is more important that the present certificates do not include any information about the methods used and about the quantity of seeds examined. These omissions should be rectified.

Finally it may be pointed out that in the Netherlands the phytosanitary certificates conforming to the International Plant Protection Convention are issued by the Government Plant Protection Service at Wageningen. The ISTA certificates with detailed information concerning the degree of disease infection in seed are exclusively issued by the Government Seed Testing Station. The results of examinations by the Seed Testing Station are included in the certificate only at the special request of the sender of the sample.

It is hoped that this short account may further the cause of disease inspection in seed testing.

Plant Disease Situation in the United States

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A Mosaic of Sweet Potato in Georgia

SWEET potatoes (*Ipomoea batatas*) are grown in Georgia not only for the roots which are marketed and used on the farms, but also for "seed" and plants. Georgia State law provides for mandatory inspection of sweet potatoes and no "seed" sweet potatoes, plants, or vine cuttings may be sold, or otherwise distributed unless certified by inspectors of the Georgia Department of Entomology as complying with Georgia regulations.

In 1945 inspectors of the Georgia Department of Entomology found off-type plants of Bunch Porto Rico sweet potato variety on a farm in one county. Symptoms resembled a mosaic type of virus infection and there was no yield of roots from the diseased plants. These symptoms had not previously been reported in Georgia. In follow-up inspections in 1946, a greatly increased number of mosaic-infected plants were found on this farm in plantings from the same stock, and the entire planting stock of this grower was condemned and destroyed. No more plants with mosaic symptoms were observed until the late summer and early autumn inspections during August to October 1952. In early autumn of that year almost all the vines in a number of sweet potato fields were found to be infected by what appeared to be a virus. The diseased plants showed a mottling of the older leaves with raised blister-like dark green areas which gave the leaves a somewhat wrinkled appearance. Such leaves frequently were distorted in outline. Many of the small veins on some young leaves showed a yellowing very similar to that caused by the feathery mottle virus (*Flavimacula ipomoeae* Doolittle & Harter). However, the mottling and blistering of the leaves were the predominant symptoms. The internodes of diseased plants were shortened and only a few very small fleshy roots were produced. Inspections by the Georgia Department of Entomology during the late summer and fall of 1953 revealed this disease in sweet potato fields in 15 counties in the coastal plain of Georgia.

In greenhouse experiments during the winter of 1952–53, inoculation of healthy sweet potato plants with extracted juice from diseased plants did not result in symptoms. However, the virus was readily transmitted when healthy cions were tip-grafted to diseased plants of Cliett Bunch Porto Rico and No. 029878 sweet potatoes, and when diseased root cores were grafted to healthy roots. Within 9 to 11 days after insertion of the cion in the infected stock, virus transmission to tip-grafts was evident in both the bunch and the vining types of sweet potatoes by the appearance of mosaic patterns on the leaves of the cion and by puckering and distortion of its leaves. Healthy sweet potato roots core-grafted with cores from infected roots produced sprouts showing the typical mottling and puckered-leaf symptoms of the virus, together with the shortened internodes and somewhat "feathery-edge" leaves.

No evidence of transmission was obtained from inoculation of young plants of various other species. The test plants included *Ipomoea purpurea*, *I. tricolor*, and a wild *Ipomoea* sp., besides several in different families.

For field experiments during the summer of 1953, a field was selected in which sweet potatoes had been completely infected during 1952. Healthy plants were protected by insect cages or by spraying with an insecticide (malathion), or were planted in alternate rows with diseased plants without protection. No virus symptoms resulted in any of the plants grown under the cages nor in the plot which had received insecticide

The healthy plants without protection grown in alternating rows with diseased plants, on the other hand, all became infected by the virus. The results indicate that the virus is not soil–borne but is carried by an insect vector.

Yield data from field plot experiments as well as from observation made in commercial fields show that healthy vines produce yield approximately 27 percent higher than vines that have become infected during the growing season. There was no yield, other than a few small culls, from virus–infected slips or vine cuttings.

Dematophora Root Rot of Strawberry in California

Collapsed and dead strawberry plants were observed in a planting of Shasta variety in Santa Cruz County of California on land recently cleared of old apple trees. The distribution of affected plants was erratic. The causal agent of the disease was determined as *Rosellinia* (*Dematophora*) *necatrix*, the fungus which had earlier caused the death of some of the apple trees.

Dematophora necatrix has been recognized in Europe as a destructive root pathogen of fruit trees for many years. It was first recognized in California in 1929 in Santa Cruz County. Strawberry is a new host.

The fungus pervades the cortex, cambial zone, and wood of the roots and crown bases, forming indefinite plaques of white tissue in the cambial zone. These plaques resemble but are not so well defined as the mycelial fans produced by the oak root fungus, *Armillaria mellea*, in strawberry. Cottony mycelial growth often grows into the surrounding soil of the roots for a short distance if sufficient moisture is present. The mycelium is composed in part of hyphae with distinct pear–shaped swellings at septa. This characteristic is useful in diagnosis. The disease is exceedingly destructive to plants attacked, but the losses throughout the field after one year have not been severe. Infection foci probably coincide with old invaded apple roots.

The field in which this outbreak occurred had been fumigated prior to planting with 30 gallons per acre of CBP–55 (Shell chlorobromopropene) applied in two treatments. Earlier tests, however, showed *D. necatrix* is exceedingly resistant to soil fungicides, possibly excepting allyl bromide. It withstands, for instance, four to five times the amount of chloropicrin required to kill *Verticillium albo–atrum*. Therefore it is doubtful whether the treatment had appreciably reduced the amount of the *Dematophora* fungus present.

Crown Canker of Multiflora Rose Cuttings in Field

Propagation of multiflora roses by means of cuttings in the field is considered to be the most economical source of budding stock in Delaware. A commercial nursery reported a 75 percent loss in 1953, involving 500,000 stuck cuttings on 24 acres. Actual spot counts showed losses ranging from 38 to 65 percent, and averaging about 50 percent. Normally a loss of 10 percent is expected owing to failure of the stuck cuttings to root for one reason or another. Thus the 1953 loss appears to be 40 to 65 percent above the normal level. The seriousness of such a loss is appreciated, because the potential value of the planting on an acre basis is 10 to 16 thousand U. S. dollars.

Symptoms on the canes closely resembled those described for crown canker and laboratory isolations showed that the crown canker fungus, *Cylindrocladium scoparium* Morgan, was associated. Apparently this is the first report of crown canker on roses in the field. The fungus is of particular interest since it is the primary causal agent of a serious disease complex in conifer seed beds. The fungus has also been isolated from ladino clover and, indeed, has a wide host range of leguminous crops under greenhouse conditions.

A New Physiologic Race of Bean Rust from New Mexico

In 1952 collections of bean rust, *Uromyces phaseoli* var. *typica* Arth. were made in three areas of pinto bean production in New Mexico, i.e., State College, Deming, and Estancia. From the six collections gathered, four physiologic races were differentiated. Three of them were identified as races, 6, 27 and 30, which had been pre-

viously recorded by Fisher[1] and others. Another race, represented by one collection from Deming and one collection from State College, appears to be hitherto unrecorded. The reaction of differential bean varieties to this race is as follows: varieties 643 and 650 very susceptible, varieties U.S. 3 and 765 susceptible, and varieties 780, 814 and Golden Gate Wax resistant.

This unrecorded race has been designated as race 31.

[1] FISHER, H. H. New physiologic races of bean rust (*Uromyces phaseoli typica*). *Plant Dis. Reptr.* 36 : 103–105. 1952.

A Supplemental Note to "Entomology Problems in Bolivia"[1]

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SINCE the publication of the article on entomology problems in Bolivia, the writer has received further information regarding the identity of three insect species reported therein and has also noticed that the species names of a few others were incorrectly quoted.

The destructive sugar cane borer, originally reported as *Metamasius anceps* Gyll., has been reidentified as *Metamasius bilobus* Hust. by the Rev. G. Kuschel of the British Museum. It is a very characteristic species whose distribution seems to be restricted to Bolivia and Peru. The illustration given by Wille[2] as *M. anceps* is also *M. bilobus*.

The fleabeetles affecting potatoes in Bolivia were found mostly to be a species near *Epitrix ubaquensis* Harokl. The identity of *Mocis latipes* (Guenée), a Noctuid injurious to rice, maize and other crops, has been verified.

The names of a few other species which need to be corrected are as follows:

Tomaspis spectabile Dist. should read *Tomaspis spectabilis* Dist.

Eriopis 17–punctata Latr. should read *Eriopis 17–pustulata* (Latr.).

Atta laerigata ligeri Santschi should read *Atta laevigata lizeri* Santschi.

[1] *See FAO Plant Prot. Bull.* 2 : 97–101. 1954.

[2] WILLE, J. E. Entomologia agricola del Peru. 2nd ed. p. 173, fig. 76. 1952.

Deficiency Diseases of Citrus in Assam, India

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ASSAM, the northeastern state of India, is an important citrus-growing province. Among the large number of citrus species and varieties grown in this state, the loose-skinned mandarin (*Citrus reticulata*) is most extensively cultivated, totalling about 25,000 acres. Next in commercial importance are limes (*C. aurantifolia*) and lemons (*C. limon*) and, to a lesser extent, shaddocks (*C. grandis*) which are usually scattered in home yards.

In addition to parasitic diseases, recent surveys have shown that certain species of citrus in Assam are seriously affected by three prevalent disorders caused by nutritional deficiencies.

Vein-Splitting

Vein-splitting due to boron deficiency, as far as observations indicate, affects only the sour orange (*Citrus aurantium*) and shaddock and occurs only in the Burnihat area where the disorder is prevalent. The most characteristic and pronounced symptoms are the enlargement, corking and splitting of the midrib and veins of the leaf (Figure 1). Leaves tend to curl downward and take on a lusterless, slightly yellowish brown or bronzed appearance. The leaf surface also becomes corky and brittle. Young fruits fall prematurely and show brownish discolorations. Older fruits become misshapen, with an unusually thick albedo containing gum deposits. Affected fruits are unusually hard and dry, and contain very little juice.

Field trials have shown that the disorder can be corrected by manuring or spraying the affected plants with borax. In soil applications, borax was applied around the plants at the rate of one pound per tree and hoed into the soil just before the monsoon. After three to four months the effect became evident as new growths were normal in appearance. The effect of the treatment, depending on the severity of the disorder, generally lasts for two to three years. Application of two pounds of borax per plant proved to be toxic because the treated trees developed irregular yellowish areas between veins and along the margins and tips of leaves.

In spraying applications one ounce of borax in three gallons of water was used. The first application was given just before the onset of the monsoon and the second application after two months. The treated plants recovered completely and the correctional effect of the treatment lasted for two years.

Mottle Leaf

Mottle leaf due to zinc deficiency is prevalent wherever the loose-skinned mandarin is grown. In most orchards 5 to 25 percent of the mandarin trees were found affected, but in a few cases incidence was as high as 45 to 60 percent. The disorder occurs also in other citrus species, but much less frequently and less seriously.

Field observations show that trees grown under drier conditions or in soil lacking in organic matter are more severely affected by this disorder. In the plantings on hills or hillocks, it has been observed that trees situated higher up are affected more frequently than those at lower levels, where the moisture is more abundant and organic matter has been accumulated through soil washings.

The characteristic symptoms of zinc deficiency observed in Assam are similar to those described elsewhere. They consist mainly of the occurrence on the leaves of irregular green bands along the midribs and lateral veins and of chlorosis in the remaining tissues (Figure 2). Narrow leaves on twigs with short internodes are also characteristic. In acute cases leaves are reduced in size and tend to stand erect. Portions

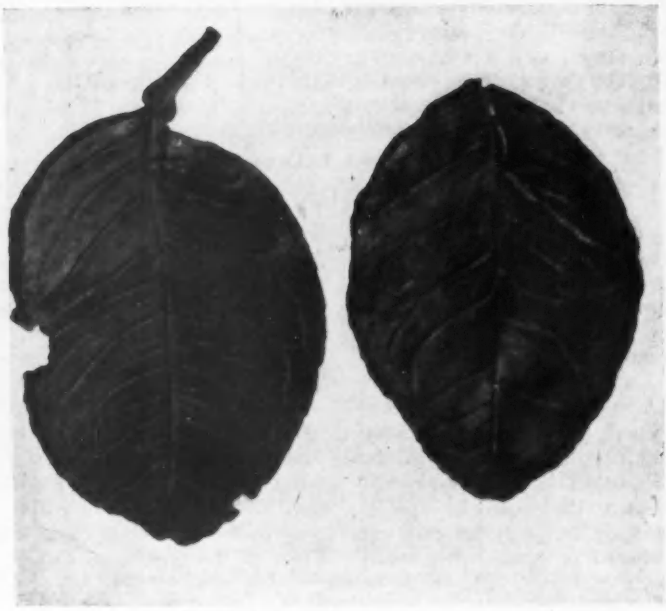

Figure 1. Vein-splitting symptoms on shaddock leaves due to boron deficiency.

Figure 2. Mottle leaf symptoms on mandarin orange leaves due to zinc deficiency.

of the affected tree, or even the whole tree, may become densely branched and stunted, with leaves dropping prematurely and twigs dying back. Fruits borne on the affected twigs are smaller and misshapen, with thicker rind and less juice than the normal ones.

Field trials carried out under varying soil conditions have shown that this disorder can be corrected by providing plentiful organic matter to the soil in the form of rotten cow dung or compost, manuring the affected trees with ammonium sulfate and bone meal, assuring adequate moisture supply and treating the affected trees with a spray containing 10 lb. zinc sulfate, 5 lb. lime and 100 gallons of water. Such treatments have resulted in the production of normal foliage and in the improvement of the yield and quality of the fruits.

Trees only slightly affected were found to recover from a single spraying with zinc sulfate and lime, while two or three sprayings were necessary for severely affected trees. The first spraying might be given in February–March, the second in May–June and the third, if necessary, in September–October. The use of powdered blood albumin as a spreader at the rate of 4 ounces per 100 gallons of spray proved to be beneficial. The effect of the sprayings lasted for three to four years depending on soil conditions and the cultural practices followed.

Instead of spraying, zinc sulfate might also be applied to the soil, at the rate of ½ to 4 lb. per tree. Soil applications, however, were less satisfactory than spray applications, because the recovery of the treated plants in the former cases was slow and sometimes uncertain.

Chlorosis

Chlorosis due to iron deficiency is not as widespread and serious as mottle leaf. It has so far been noticed as affecting mainly the loose-skinned mandarin and more rarely Valencia (*C. sinensis*) and lime. The mandarin orange grown under poor soil conditions, in soils having an inadequate moisture supply and underlaid with limestone or other calcareous material has been found in general more frequently affected. This accounts for the prevalence of this disorder in trees on the southern slopes of the Khasi and Jainta Hills and on the North Cachar Hills.

On iron deficient trees leaves show chlorotic areas which may be confined to a few spots or may extend almost to the whole leaf surface. In the latter case only very fine green bands may be seen along the midrib and bases of the secondary veins, on a pale or yellowish background. The symptoms may be evident only on a few leaves or a few branches, though in some cases all the leaves on a tree are involved.

The yield of an affected tree decreases considerably, producing smaller fruit or no fruit at all.

Although correctional treatments for iron deficiency in citrus are generally regarded as unsatisfactory in North America, field trials carried out in Assam have shown that this disorder may be corrected in some cases by spraying the affected trees with iron salts, preferably ferrous sulfate, at the rate of one pound per 1,000 gallons of water. Blood albumin may be added as a spreader at the rate of 4 ounces per 100 gallons of spray. Affected trees usually recover after one or two sprayings, the first in February–March and the second in July–August. The effect of such treatments lasts for two to three years if proper cultural practices are adopted.

Soil application of ferrous sulfate at the rate of ½ to 2 lb. per tree has also been found, in a few cases, to produce beneficial effects, but in alkaline soil where typical iron deficiency occurs the iron is unlikely to become available to the plants in a soluble form.

In addition to treatment with ferrous sulfate the affected trees should be manured adequately with rotten cow dung or compost, oil cake, bone meal and ammonium sulfate, and adequately supplied with water.

Injections of iron citrate and iron tartrates into the trunks of affected citrus trees have not been found effective in remedying the disorder.

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Outbreaks and New Records

Italy

Plant Protection Service
Ministry of Agriculture, Rome

Olive Thrips

The olive thrips, *Liothrips oleae* Costa, a species common in the Mediterranean region, was found repeatedly in March and April 1954 in the central part of the country. Infestation was widespread in Tuscany (Pistoia, Livorno, Lucca, Siena, and Arezzo) and in many places of Umbria. The phytopathological laboratory at Florence has undertaken control operations in the infested area. To popularize methods for controlling this thrips, several demonstration fields have been set up in many olive groves in Pistoia and Siena, using insecticides containing DDT and BHC.

Scale Insect on Poplars

The polyphagus oyster-shell scale, *Lepidosaphes ulmi* L. (= *Mytilococcus ulmi* L.), was reported to attack young poplar trees very heavily at Mondovi in Piedmont during March and April. A remarkably high percentage of young trees was killed by the infestation.

Papua and New Guinea

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The following notes summarize the results of a survey on the occurrence of the bunchy top disease of *Musa* spp. (edible banana, wild banana and manila hemp), and on the incidence of other virus diseases of plants generally, undertaken by Dr. C. J. Magee, Chief Biologist of the New South Wales Department of Agriculture, Sydney, who visited the Territory of Papua and New Guinea during July and August 1951 on behalf of the Australian Government.

Dr. Magee visited the following areas: Port Moresby and district; Rabaul and the Gazelle Peninsula; Manus Island; Kavieng (New Ireland); Sohano (Bougainville); Lae and environs; Wau; Bulolo; Madang; Wowak; numerous stations in the Eastern and Western Highlands; Popondetta–Saiho–Oro Bay area of the Northern District; and Kokoda.

Incidence of Diseases of *Musa* spp.

Bunchy top. No sign of bunchy top disease was seen in bananas or wild *Musa* spp. in any part of the Territory.

Close attention was given to the plots of abaca (*Musa textilis*) growing at the Lowlands Agricultural Experiment Station at Keravat, near Rabaul, from stocks imported from the Philippines in about 1930. No abnormal features were noticed in the plot planted in 1949. However, younger plants established in December 1950 and February 1951 revealed an abnormal habit of growth. Although the growth of most of the stocks was fairly vigorous, the suckers of many, after commencing normally, developed a series of narrow leaves with chlorotic areas and other features which are typical of some of the

symptoms of bunchy top in abaca. Dr. Magee considered that these symptoms indicated that at some time in its history, this variety of abaca at Keravat had been infected with bunchy top and that it was carrying a chronic infection which affects the plants only during the early stages of growth.

This opinion is supported by evidence of observations made on the Veimama variety of banana of Fiji and the Tangongon and Bangkura varieties of manila hemp in North Borneo, which are considered to have made a partial recovery following bunchy top infection.

Although the insect vector of the bunchy top virus, *Pentalonia nigronervosa*, is plentiful in Papua and New Guinea, there were no signs of the spread of the disease to bananas or wild *Musa* spp. from the abaca stocks at Keravat. It is therefore reasonable to conclude that the virus is not in a stage where it can be readily transmitted. However, there was no certainty that a mutation of the virus or some other cause may not render it infective. As bunchy top is not known to be transmitted in the seed, Dr. Magee recommended that all abaca stocks in Papua and New Guinea should be destroyed, and fresh stocks of the species established from seed. This recommendation was carried out and at the present time about 30,000 seedlings are being raised in nurseries.

Mosaic or infection chlorosis. This virus disease, which is caused by a strain of cucumber mosaic virus, was encountered on the Gazelle Peninsula at Lae and at Madang.

The acute form of the disease was seen on two occasions only in native gardens on the Gazelle Peninsula where bananas were interplanted with European and native vegetables. The disease was considered to have been spread to the few banana plants which were affected by aphids (*Aphis gossypii*) which have migrated from vegetable crops.

Cercospora leaf spot. This disease, caused by the parasitic fungus *Cercospora musae*, is to be seen in every part of the Territory, except the Central Highlands of New Guinea, causing spotting of leaves and defoliation. The disease reduces the quality of the fruit but under present conditions of banana production in the Territory the disease is of little economic importance. It is of interest that the variety of abaca grown at Keravat is highly resistant or immune to *Cercospora* leaf spot.

Other diseases of Musa *spp.* No disease of *Musa* spp. other than those discussed above was encountered during the survey.

Other Plant Virus Diseases

Aibika (spinach) mosaic. A mosaic disease of native spinach (*Hibiscus abelmoschus*) was noted at Paragum in New Britain, causing a light and dark green mottle and malformation of the leaves, also stunting. Plants affected by tobacco mosaic and cucumber mosaic were growing in the same garden. No reference has been found in the literature to a mosaic disease of aibika.

Canna mosaic. This disease is another manifestation of the cucumber mosaic virus, but only one infected plant was encountered, namely in New Britain.

Legume mosaic. Mild to severe mosaic mottling of the foliage, sometimes accompanied by pronounced stunting, is widespread in leguminous shade and cover crops in most parts of the Territory. This disease is common in both Highland and Lowland areas. It is considered probable that a single virus is responsible for most, if not all, infections and that it manifests itself with a variety of symptoms according to the species attacked. It is possible that it is the common pea mosaic virus which has a wide host range among leguminous plants, and is transmitted by several species of aphids, but is not transmitted through seed.

Mosaic symptoms were seen in: *Centrosoma pubescens*; *Desmodium* sp.; *Uraria lagopodioides*; *Tephrosia* sp.; *Crotalaria striata*; *Crotalaria anagyroides* and *Dolichos hosei*. Minor and doubtful symptoms were seen on *Stylosanthes* spp.; *Clitoria ternatea*; *Stizolobium* spp. and *Ponciana* sp., while *Calopogonium* sp. and peanuts (*Arachis hypogaea*) seemed to have escaped infection or were resistant.

Maize mosaic. Mosaic disease of maize (*Zea mays*) was seen in only one locality, namely at Sogeri near Port Moresby. The symptoms of mottling and stripping appeared to resemble those caused by the cucumber mosaic virus in maize rather than those of the leafhopper–transmitted corn mosaic.

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Cucumber mosaic. The host plant range of this virus is very wide and the virus is fairly widespread in the Territory where it causes a number of diseases. However, no serious outbreaks were seen. The outbreaks were mainly local and indicated that a few infective aphids had spread from restricted infection centers.

It is of special interest to note that in both the Lowlands and Highlands of New Guinea, the woodiness disease of passion fruit (*Passiflora edulis*), which is caused by strains of the cucumber mosaic virus, is either not present or is masked to such an extent that it escapes notice. This fact would tend to make conditions in the New Guinea Highlands particularly suitable for passion fruit culture.

Pandanus yellow spot mosaic. A striking yellow ring–spot mosaic was noticed near Rabaul in a small planting of pandanus.

Papaya mosaic. The papaya (*Carica papaya*) of the Territory are surprisingly free from virus diseases, but in one area at Saiho in the Northern District of Papua, several plants showed a mild mosaic infection. Cucumbers and maize were present in the same garden, and the symptoms on papaya might have been another manifestation of the cucumber mosaic virus.

In the Central Highlands of New Guinea, almost every papaya plant showed a conspicuous mottling of the younger foliage. The vigor of the plants was unaffected. This mottling, which superficially resembles a mosaic of virus origin, is caused by the powdery mildew fungus (*Erysiphe* sp.).

Peanut mosaic. Special attention was paid to peanut crops, but no sign was seen of the peanut rosette virus.

Betel pepper mosaic. A mosaic of *Piper betle* was seen in native gardens near Rabaul. Although the mottling of the foliage was conspicuous, the vigor of the affected plants was still satisfactory.

Potato leaf roll. The disease was seen in most potato crops (*Solanum tuberosum*) in the Highland areas of New Guinea.

Mosaic of taro. Taro (*Colocasia* spp.) crops in most areas visited were infected with a mosaic disease. The disease appears to have an acute form and a chronic form and the different varieties, which are usually intermixed in native plantings, seem to vary in sensitivity to the virus. The acute form causes marked stunting of affected plants with chlorosis, twisting and malformation of the central leaves. The symptoms of the chronic form are variable, ranging from a prominent yellow mottling or streaking of the leaves without much malformation to an almost imperceptible minor streaking of the foliage. No reports in the literature have been found of a virus disease of taro. The possibility should be entertained that the disease is caused by the cucumber mosaic virus which is widespread in the Territory.

Tomato mosaic. Plantings of tomatoes (*Lycopersicum esculentum*) in a number of parts of the Territory were examined, but the spotted wilt virus was not seen.

Symptoms caused by the tobacco mosaic virus were observed in New Britain.

Tobacco mosaic. This disease was present in almost all tobacco (*Nicotiana* spp.) plants seen in Lowland areas. It was seen also in the Highlands, but symptoms there were milder, probably as a result of masking by lower temperatures.

Mosaic of yam. A mosaic disease of yams (*Dioscorea* spp.) was encountered near Lae. The disease caused mottling, vein clearing and distortion of the leaves, with some reduction in vigor of the plants.

Other crops. Sweet potato (*Ipomea batatas*) is perhaps the most important native food crop and was found to be free from virus diseases. The "rosette" or "leaf curl" of this crop which is seen in some parts of the Territory is believed to be the direct result of insect attack. A mosaic disease of sweet potato can be caused by cucumber mosaic virus but no sign of this disease was seen in spite of the suspected prevalence of the virus.

In many parts of the tropics (e.g., Gold Coast, Congo, Cameroons, Liberia, Madagascar, Java), cassava (*Manihot utilissima*) is attacked by a virus disease. No sign of any virus disease was seen in this crop in the Territory, where it grows luxuriantly.

Conclusion

In his conclusion, Dr. Magee states that the plant health position in the Territory of Papua and New Guinea can be regarded as surprisingly good, particularly when one

realises that a great many introductions of plants have been made over the years. No serious introduced disease was seen causing losses to either food crops or plantation crops such as coconuts, cacao, coffee, cinchona and tea.

In view of the above very satisfactory position, Dr. Magee recommended the further development of the Territorial plant quarantine service, and the framing of regulations to give greater protection to existing or future agricultural industries.

Unites States

Plant Pest Control Branch
Agricultural Research Service
United States Department of Agriculture

Gypsy Moth Recorded in Michigan

A limited infestation of the gypsy moth, *Porthetria dispar* (L.), was discovered in an area involving approximately 10,000 acres at Lansing, Michigan, 20 May 1954. This find represents the most westward infestation of this forest pest beyond the quarantined areas of the northeastern states. Immediate action was taken to eradicate the Michigan infestation through application of DDT by air and ground equipment. Plans for an extensive trapping program for adults during the summer months and for further scouting in the autumn of 1954 have also been formulated.

Khapra Beetle Survey in Western States

Recent surveys for the khapra beetle, *Trogoderma granarium* Everts, show this serious pest of certain stored products to be rather widespread in California and Arizona with smaller infestations being reported from New Mexico. It has been recorded in 7 counties of California, 5 in Arizona and 2 in New Mexico. This pest was first identified as being present on the North American continent in November 1953 from specimens collected in California.

PLANT QUARANTINE ANNOUNCEMENTS

Netherlands

A decree, which was published in the *Staatscourant* No. 73, 14 April 1954, and came into force 4 April 1954, prohibits the importation of soil as a packing material for plants from the United States and Japan, in order to prevent the introduction into the Netherlands of Japanese beetle (*Popillia japonica*). Under special conditions, exemption from this prohibition may be granted by the Netherlands Plant Protection Service.

The provision mentioned above is not applicable to plants with earth balls attached, for which inspection or disinfestation will be carried out after entry.

United Kingdom

1. The Importation of Raw Cherries (General Licence) Order, 1954, which came into force on 16 June, removed, for the period from 16 to 30 June 1954, the prohibition imposed by the Importation of Raw Cherries Order, 1954 (see *FAO Plant Prot. Bull.* 2 : 111. 1954), on the importation of raw cherries from Austria, Bulgaria, southern France, Hungary, northern Italy and Yugoslavia. Consignments imported during this period from those countries were required to be accompanied by a certificate of health issued in the prescribed form by the phytopathological service in the country of origin.

2. The Importation of Plants from Belgium, France and the Netherlands (General Licence) (Scotland) Order, 1954 and the Importation of Plants from Belgium, France and the Netherlands (Exemption) (Northern Ireland) Order, 1954, modify restrictions imposed under the Importation of Plants Orders, 1947 to 1953, in the case of certain produce imported from Belgium, France and the Netherlands during specified periods of the year 1954. The provisions of both new Orders are essentially the same as those of the recent Order relating to England and Wales, (see *FAO Plant Prot. Bull.* 2 : 124. 1954), except that the Scotland Order does not cover potatoes from France and later imports of cabbage from the Netherlands, and that the Northern Ireland Order does not cover potatoes from France.

NEWS AND NOTES

Rectified Spanish Text of the International Plant Protection Convention

When the International Plant Protection Convention was printed during the Sixth Session of the FAO Conference in 1951, several words, by a regrettable oversight of the printers, were omitted from the Spanish version of the text approved by the Conference. A rectified version of the Spanish text was accordingly presented to and approved by the Seventh Session of the FAO Conference in 1953, to eliminate discrepancies between the Spanish text and the English and French texts.

According to Article XIII of the Convention, any amendment shall come into force as from the thirtieth day after acceptance by two-thirds of the contracting governments. The rectified Spanish text has now been accepted by eighteen signatory and adhering governments and entered into force 11 July 1954.

Iraq Adheres to the International Plant Protection Convention

The instrument of adherence of the Government of Iraq to the International Plant Protection Convention, dated 2 March 1954, was received by the Director-General of FAO on 1 July 1954. The number of countries contracting to the Convention, including both signatory and adhering members, is, at the time of writing, twenty-one, namely: Australia, Austria, Belgium, Cambodia, Canada, Ceylon, Chile, Denmark, Dominican Republic, Egypt, El Salvador, India, Indonesia, Iraq, Japan, Korea (Republic of), New Zealand, Philippines, Spain, Sweden and the United Kingdom.

Desert Locust Meetings

The Co-ordinating Committee for the Control of the desert locust in the Arabian Peninsula which met in Cairo, 7 to 10 June 1954, was attended by delegates and representatives of eleven countries and FAO, and observers from the Arab League. The Committee reviewed the results of the 1954 international anti-locust campaign in Arabia and detailed the requirements for the 1954-55 campaign. Despite the unprecedented spirit of co-operation shown in 1954, the Committee concluded that the campaign had been inadequate. In order that all affected countries may appreciate the danger and may take steps to overcome the deficiencies in time for the 1954-55 campaign, it was recommended that FAO should convene in the near future a working party on desert locust control.

This working party, to which all countries directly affected by the desert locust and others which participate in international campaigns will be invited, is planned to be held in Rome 13-17 September 1954.

The FAO Technical Advisory Committee on Desert Locust Control, which also met in Cairo, was attended by delegates from all seven member countries and by observers from Saudi Arabia and the Arab League. The Committee concluded that the Desert Locust plague covered almost the maximum area ever known to be invaded and considered that very greatly increased action on an international scale was required to prevent disastrous developments. The Committee also reviewed recent developments in locust control techniques, particularly the use of aircraft.

International Congress on Mediterranean Citrus Culture

The Third International Congress on Mediterranean Citrus Culture was held in Algiers, 9-15 May 1954. It was attended by representatives from 12 countries, namely: Algeria, France, French Morocco, Israel, Italy, Lebanon, Libya, Spain, Syria, Tunisia, Turkey, and the United States. FAO was represented by an observer.

The Congress was divided into three sections, dealing with citrus production, trade, and industry respectively. In the production section, technical papers and discussions were presented on psorosis and other virus diseases of citrus, the *mal secco* disease, the use of newer insecticides, the ecology and control of the Mediterranean fruit fly, and disorders caused by nutritional deficiencies. In order to effect better co-ordination on researches concerning citrus production and protection, it was agreed that a permanent sub-committee be established within the frame of the existing Permanent Liaison Committee on Mediterranean Citrus Culture.

The Fourth Congress will meet in Tel-Aviv in the late spring of 1956.

DIGEST OF PLANT QUARANTINE REGULATIONS: FIRST SUPPLEMENT

In advancing the objectives of the International Plant Protection Convention of 1951, a new edition of the Digest of Plant Quarantine Regulations, covering forty countries and territories, was issued in 1952 as FAO Agricultural Development Paper No. 23 (English, French and Spanish editions. Price $ 2.00 or 10s.). In addition to providing a medium for circulating information on legislation governing the imports of plants and plant products, it was considered that a better mutual understanding among governments would stimulate the improvement of existing plant quarantine measures and would lead to fuller international co-operation in the field of plant protection.

The First Supplement to this publication was published in May 1954 in mimeographed form. It contains summaries of the plant quarantine legislation of thirty-eight countries and territories which were not covered in the Digest, namely:

Antigua
Barbados
Bermuda
British Guiana
British Honduras
British Solomon Islands
British Virgin Islands
Cambodia
Costa Rica
Denmark
Dominica
Falkland Islands
Fiji
Gambia
Gilbert and Ellice Islands Colony
Gold Coast
Grenada
Kenya
Maltese Islands
Mauritius
Montserrat
Nigeria
North Borneo
Northern Rhodesia
Saint Christopher and Nevis
Saint Helena
Saint Lucia
Saint Vincent
Sarawak
Sierra Leone
Singapore
Spain
Spanish Morocco
Sudan
Tonga
Trinidad and Tobago
Uganda Protectorate
Zanzibar Protectorate

The Digest and supplements are complementary to the plant quarantine announcements published in this Bulletin, with which they should be read. Further supplements will be issued from time to time to cover additional countries.

The First Supplement has been supplied to the plant protection services of all FAO Member Governments and is obtainable from Plant Production Branch, Agriculture Division, FAO, Rome.

Roma - Tip. del Senato del dott. Giovanni Bardi